

**IV B.Tech. II Semester Supplementary Examinations, July -2005**  
**OPERATIONS RESEARCH**  
**(Chemical Engineering)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) Give a brief account of the methods used in model formulation.  
 (b) Explain the meaning and nature of Operations Research.
2. (a) Give a generalized mathematical model of Linear Programming Problem.  
 (b) Explain what is Basic Feasible Solution?  
 (c) State the Theorem of Linear Programming Problem.  
 (d) Explain the significance of Key Row, Key Column and Key Number and Replacement ratio with respect to a Simplex Table.
3. (a) Explain a Traveling salesman problem.  
 (b) Find the sequence that minimizes the total elapsed time required to complete the following jobs.

*Processing time in hours*

No. of job	1	2	3	4	5	6
Machine A	4	8	3	4	7	5
Machine B	2	3	7	6	8	4

4. A machine costs Rs.12000 when new. The running costs are Rs.1920/- for the first 5 years, increasing by Rs.480/- per year thereafter. Assuming a 10% discount rate of money per year. Find the optimum length of time to hold the machine before we replace it.
5. (a) List the different types of strategies and explain them briefly.  
 (b) Two players A and B match points .If the points match, then A wins one unit of value, if the points do not match, then B wins one unit of value. Determine optimum strategies for the players and the value of the game.
6. (a) Explain balking, reneging collusion and jockeying. Write Question Theory.  
 (b) Write a note on “ Kendalls Notation”
7. (a) Derive an expression for E.O.Q for an inventory model with uniform demand and instantaneous replenishment with no shortages  
 (b) Explain why inventory control is important in an industry. Mention its advantages and disadvantages.
8. (a) Discuss the basic features of the dynamic programming problem.

- (b) Solve the following linear programming problem by using dynamic programming technique

$$\max z = y_1 y_2 y_3$$

subject to the constraints:  $y_1 + y_2 + y_3 = 5$ ,  $y_1, y_2, y_3 \geq 0$ .

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1. Discuss the advantages and disadvantages or limitations of using results from a mathematical model to make decisions about operations.
2. A transport company with Rs. 40,00,000 to spend is contemplating to purchase three types of vehicles. Vehicle A has 10 tons pay load and expected to average 35 Km. per hour and it costs Rs. 80,000. Vehicle B has 20 ton pay load, expected to average 30 Km per hour and costs Rs. 1,00,000. Vehicle C is modified form of B. It is having provisions for sleeping for one driver and its capacity is 18 tons and averages to 28 Km per hour. A and B with one driver can run 12 hours per day. C requires 2 drivers and runs 20 hours per day. Company has 100 drivers available. Maintenance facilities restrict the total vehicle to 30. Formulate this as a linear programming problem to maximize ton kms. Write starting simplex tableau. Carry out only two iterations.
3. (a) Give a brief note of Johusan and Bellman rule.  
 (b) There are seven jobs as under each of which has to go through machines A and B in the order BA. The processing time is in hours.

Job	1	2	3	4	5	6	7
Machine A	12	10	10	6	8	1	3
Machine B	10	12	15	6	3	11	9

Determine the sequence of jobs that will minimize the total time for completion of all the jobs.

4. A manual stamper currently valued at Rs.1000/- is expected to last 2 years and costs Rs.4000/- per year to operate. An automatic stamper which can be purchased for Rs.3000/- will last 4 years and can be operated at an annual cost of Rs.3000/-. If money carries the rate of interest 10
5. A and B play a game in which each has three coins 5 paise, 10 paise and 20 paise. Each selects a coin without the knowledge of other's choice. If the sum of coins is an odd amount, A wins B's coin, if the sum is even B wins A's coin. Find the best strategies for each player and the value of the game.
6. (a) Describe the fundamental components of a queuing process and give suitable examples.  
 (b) Explain briefly the main characteristics of a queuing system.
7. (a) A Company uses annually 48000 units of a raw material costing Rs. 1.20 / unit. Placing each order costs Rs. 45 /-, carrying cost is 1.5

- (b) Discuss the impact on lot size if shortages are allowed.
8. (a) Define the following terms in dynamic programming
- State variable
  - decision variable
  - Optimal return
- (b) Min.  $z = x_1^2 + x_2^2 + x_3^2$   
Subject to  $x_1 + x_2 + x_3 \geq 18$   
 $x_1, x_2, x_3 \geq 0$

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1. Explain how and why Operations Research methods have been valuable in aiding executive decisions.
2. (a) Explain the use of artificial variable and its use in linear programming.  
 (b) An animal feed company must produce 200 Kg of a mixture containing of ingredients A and B respectively. Ingredient A Costs Rs. 3/- per Kg. And B costs Rs. 8/- per Kg. No more than 80 Kg of A can be used and at least 60 Kg of B must be used. Find how much of each ingredients should be used if the company wants to minimize cost.
3. Find the sequence that will minimize the total time required to complete the following tasks on two machines  $M_1$  and  $M_2$ , in the order  $M_2 M_1$ .

Task	A	B	C	D	E	F	G	H	I
Machine $M_1$	6	8	7	9	3	4	3	8	11
Machine $M_2$	2	5	4	8	6	9	7	5	4

4. A truck with first cost Rs.80,000/- has depreciation and service pattern shown below:

Year	1	2	3	4	5	6
Depreciation	28,000	20,000	14,000	5,000	4,000	4,000
Service cost	18,000	21,000	25,000	29,000	34,000	40,000

Determine the age at which the truck should be replaced.

5. Two players A and B play the following game. A has a bag containing three coins, one worth 1 unit, one 3 units and the rest worth 6 units. A takes one coin from the bag and before it is exposed, B guesses what it is? If B guesses rightly, he takes the coin, if he is wrong, he gives to A a coin of the same worth. Find the best sorting and value of the game.
6. (a) What is a queuing problem? Explain queuing system, transient and steady state  
 (b) What is a queue? How are they classified? Explain each briefly.
7. (a) Explain the type of inventory.  
 (b) Distinguish between "All unit discounts and Incremental discounts".  
 (c) Explain the cost associated with inventory.

8. (a) In what areas of management can the dynamic programming be applied successfully.
- (b) Use dynamic programming to solve the following problem: Max.  $z = x_1 + 9x_2$   
Subject to :  $2x_1 + x_2 \leq 25, x_2 \leq 11, x_1, x_2 \geq 0$

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1. (a) Explain the meaning and nature of Operations Research.  
 (b) Write a note on Scope of Operations Research.
  
2. (a) A feed mixing operation can be described in terms of the two activities. The required mixture must contain four kinds of ingredients i.e. W, X, Y and Z. Two basic feeds A and B, which contain the required ingredients, are available in the market. One Kg. Of A contains 0.1 Kg of W, 0.1 Kg of Y and 0.2 Kg of Z. Likewise one Kg of feed B contains 0.1 Kg of X, 0.2 Kg of Y and 0.1 Kg of Z. The daily per head requirement is of at least of 0.4 Kg of W, 0.6 Kg of X, 0.2 Kg of Y and 1.8 Kg of Z. Feed A can be bought for Rs. 15 per Kg and B can be bought at the rate of Rs. 10 per Kg.  
 Determine the quantities of feeds A and B in the mixture so that the total cost is minimized.  
 (b) What is dual of a dual?  
 (c) What is primal of a Primal?  
 (d) What is dual of a Primal?  
 (e) What is dual of a dual of dual?
  
3. A book binder has one printing press, one binding machine, and the manuscripts of a number of different books. The cost of the printing and binding operations for each book are known. Determine the order in which books should be processed, in order to minimize the total production cost.

Book	Printing cost (Rs.)	Binding cost (Rs.)
1	550	45
2	1400	120
3	800	75
4	350	45
5	1250	100
6	600	50

4. The following mortality rates have been observed for a certain type of light bulbs:

Week	1	2	3	4	5
Perecent failijng by week end	10	25	50	80	100

There are 1000 bulbs in use and it costs Rs.2 to replace an individual bulb which has burnt out. If all the bulbs were replaced simultaneously it would cost 50 paise per bulb. It is proposed to replace all bulbs at fixed intervals, whether or not they

- have burnt out, and to continue replace burnt out bulbs as they fail. At what interval should all the bulbs be replaced?
5. Two children play the following game named “scissors, paper, stone”. Both players simultaneously call one of the three- scissors, paper or stone. Scissors beat paper (as scissors cuts papers)., paper beats stone (as stone can wrapped in paper) and stone beats scissors(as stone can blunt scissors). There is a tie if both call the same thing if there is one point for win, Zero for the tie and -1 for the loss. Form the payoff matrix of the game and solve it and give the optimal strategies of the players and the value of the game.
  6. (a) What are the application of queuing theory?  
(b) Describe the advantage of queuing theory to business executive with a view to persuade him to make use of the same.
  7. A commodity is to be supplied at a constant rate of 20 units per day supplies of any amounts can be has at any required time but each ordering costs Rs.50 the cost of holding the commodity in inventory is Rs 60 per unit per month of 30 days. While the delay in supply of the item induces a penalty of Rs 10 per unit per day delay. Determine optimum order quantity and the corresponding shortage quantity.
  8. (a) Explain the need of the dynamic programming techniques.  
(b) Use dynamic programming to solve the following problems :  
Max.  $z = 3x_1 + x_2$   
Subject to :  $x_1 \leq 2, x_2 \leq 2, 2x_1 + x_2 \leq 6, x_1, x_2 \geq 0$

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